Original Article :

Assessment of Knowledge, Attitude and Practice Regarding Insulin Use and Its Adverse Effects in Adult Diabetic Population in A Tertiary Care Hospital

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Abstract

Background and Aims:

A proper assessment and understanding of knowledge, attitude and practice factors among patients is helpful in diabetes, for which prevention and control necessitate a lifelong adoption of healthy lifestyles. This study aims to assess the knowledge, attitude and practice regarding insulin use and its adverse effects among diabetic population.

Methods:

A cross sectional, observational, questionnaire based study was conducted over a period of three months on patients of both type 1 and type 2 diabetes mellitus on insulin therapy for more than three months and attending medicine/diabetes out patient department in a tertiary care hospital. A pretested structured questionnaire comprising of 27 items was administered through face-to-face interview.

Results:

Responses from 295 subjects were analyzed. Most of the subjects were unaware of different types of insulin (65.8%), believed that insulin could be stopped once blood glucose levels normalize (63.1%) and did not keep a readily available source of blood glucose when went out (53.9%). Males were more knowledgeable regarding insulin use and adverse effects compared to female (p =0.0063). Higher education was associated with good practice regarding insulin use (p=0.0287). Longer duration of diabetes was associated with better knowledge (p=0.0004). Longer duration of insulin use was associated with better knowledge (p=0.0001) and practice (p=0.0155).

Conclusions:

A proper educational intervention is needed that may create the awareness among insulin users on the aspect of knowledge that would rather improve their attitude and practice.

Keywords:

Insulin, Knowledge, Attitude, Cross sectional, Questionnaire.

Introduction

Diabetes mellitus (DM) may be considered as a group of metabolic disorders with a common characteristic feature of hyperglycaemia. Its pathophysiology may encounter a complex interaction with various environmental and genetic factors that ultimately results in reduced insulin secretion, reduced utilization and increased production of glucose[1]. Currently DM affects over 451 million people globally and depending upon this trend the International Diabetes Federation (IDF) projects that by the year 2045, about 693 million individuals will be suffering from diabetes[2]. Considering the view of increased obesity, reduced level of physical activities and ageing of people, type 2 DM becomes the most prevalent. India is going to be considered as the capital for diabetes in the world. Presently, India inhabits approximately 72 million diabetic patients and this figure is substantially going to increase by 2025[3].

Among the anti-diabetic medicines, insulin is the oldest. For the reduction of hyperglycaemia, it is considered as the most effective agent. Has it been used in appropriate doses, insulin can reduce any level of raised HbA1c to the therapeutic target. No maximum dose of insulin has been found beyond which therapeutic failure will occur[4]. Insulin is the only treatment option for type 1 diabetes. However with the progression of type 2 diabetes also, insulin is frequently needed. According to various studies, insulin is used either singly or along with oral anti diabetic drugs (OADs) in more than 30% of diabetic patients in developed countries[5], though Indian figure may be less in this regard[6].

However, it has been found that both the health care providers as well as the patients show a negative attitude regarding initiation of insulin therapy[7]. Patients' consideration often reflect the fact that initiation of insulin therapy would mean their "failure" in the aspect of proper diabetes self management. Other reasons for resistance to insulin therapy are the beliefs that administration of insulin will cause much confined life as well as more restricted day to day movements. Also there is belief among diabetics that once they use insulin, people will treat them differently. This ultimately makes DM very difficult to manage[8].

Acceptance and adherence of diabetic patients to insulin therapy is likely to be influenced by their inadequate knowledge regarding insulin and its adverse effects. As insulin is an injectable drug, various misconceptions may influence its use. Few published Indian literatures emphasised on diabetes epidemiology[9-12]. However only limited number of studies had been

conducted to assess the knowledge, attitude and practice (KAP) regarding use and adverse effects of insulin among diabetic population[13-15].

It appears that assessment of KAP regarding use and adverse effects of insulin is necessary for the evaluation of the existing gaps that need to be addressed. Assessment of KAP among the diabetic population using insulin is necessary for future development of programs and techniques for management of DM effectively. Therefore, we conducted this study to assess the patients' KAP regarding use and adverse effects of insulin in adult diabetic patients in our institute.

Methods

This was an observational, cross sectional questionnaire based study conducted in a tertiary care hospital in Eastern India. Adult diabetic patients (age between 18 and 70 years) of either sex on self-administered insulin therapy for more than three months attending medicine and diabetic out patient departments (OPD) were included in the study. On the other hand, subjects with poor mental conditions and critically ill were excluded from the study. Pregnant and lactating females were also excluded. The study period was three months, ranging from June 2021 to August 2021. Following the approval of institutional ethics committee (Ref No: MC/KOL/IEC/NON-SPON/819/09/20), the study was commenced. An informed written consent in a language the study participants could best understand was taken from the subjects before their enrolment. The study protocol conformed to the ethical guidelines of the 1975 declaration of Helsinki. Assuming a 50:50 response distribution on the question of a subject's actual insulin use, with 95% confidence interval and 5% margin of error, the calculated sample size was 295. Collection of the study data was done by using interviewer administered structured questionnaire containing four parts: Data regarding socio demographic profile was collected using part one (Part I) of the questionnaire. In this part information like age, sex, occupation, income, marital and educational status, profession, past medical history, family history of diabetes, type and duration of diabetes and duration of insulin use was elicited. Data regarding type, regimen and insulin device used were also collected. Part II, part III and part IV were used to collect data regarding the patients' knowledge (part II), attitude (part III) and practice (part IV) towards insulin use and its adverse effects.

The questionnaire was taken from a literature and modified[16]. Initially the modified questionnaire was prepared in English, which was later translated into local ver-

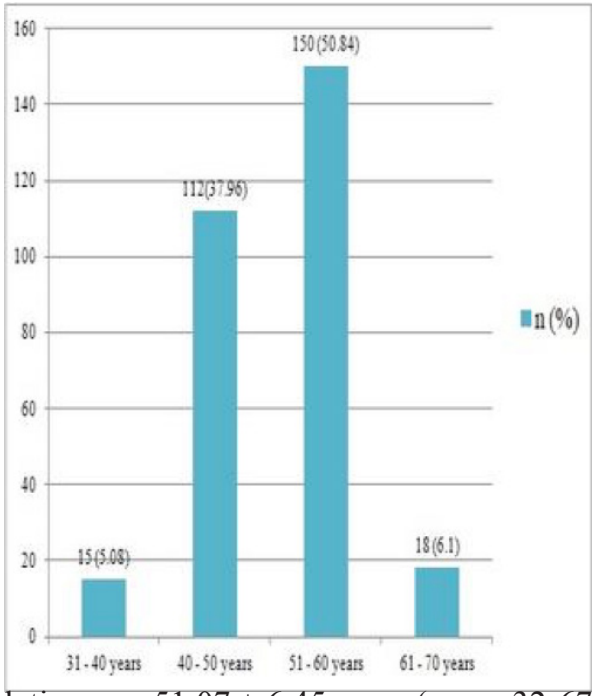
nacular (Bengali and Hindi) by language experts. To maintain consistency, the Bengali and Hindi version of questionnaire were retranslated back to English by another language expert. To nullify any ambiguity in interpretation of response, the questionnaire was pretested over a 30 ambulatory diabetic patients who were using insulin and completed at least post secondary level of education. These subjects did not participate in the main study. Definition or categorization of all the subjective terms was done, and if three or more respondents faced difficulty with a question, it was reworded or reframed. After a two weeks gap, re-administration of the revised questionnaire was done to the same 30 subjects to nullify any ambiguity. The final questionnaire was comprised of 27 (knowledge = 10, attitude = 10 and practice = 7) questions to assess KAP regarding use and adverse effects of insulin. Closed type questions with multiple options were used for the assessment of patients' knowledge in this respect. Each correct and incorrect response was scored one and zero respectively. Attitude was assessed by ten questions each of which had the options: strongly agree, agree, unsure, disagree and strongly disagree. Regarding assessment of practice, response indicative of good and bad practice was scored one and zero respectively. The data collection was done by three trained undergraduate medical students. At the time of collection, data was checked daily for clarity and completeness of the filled questionnaire.

Statistical analysis

Statistical Package for the Social Sciences (SPSS) version 20.0 was used for the purpose of study data analysis. Qualitative data was expressed as frequency and percentage and quantitative data were presented as mean ± standard deviation (SD). For comparison of means between two distinct groups, independent t-test was used. The p-value <0.05 was considered as statistically significant.

Results

The study was conducted on 295 diabetic patients. The mean age of the study population was 51.07 ± 6.45 years (range 32-67



years). Figure 1 provides the age wise distribution of the study population.

Most of the patients were in the age group of 51-60 (50.84%) years followed by 41-50 (37.96%) years and 61-70 (6.1%) years. Patients with age group of 31-40 (5.08%) were found to be the least. Most of the subjects were males (53.6%). At least primary level of education was completed by nearly all the participants (87.5%) and most of them were unemployed (52.2%). More than three fourth of the participants were married (95.3%). Most of the subjects had a negative family history of diabetes (58.6%). Mean duration of DM was of 6.81 ± 4.6 years. Most of the subjects had type 2 DM (98%) and along with insulin, they were on oral anti-diabetic drugs also. Mean duration of taking oral anti-diabetic medications was 6.64 ± 4.43 years. Mean duration of insulin use was 4.49 ± 3.18 years and regarding insulin device, most of the subjects were using insulin syringe (53.6%) followed by insulin pen (46.4%).

Knowledge regarding insulin use and adverse effects

According to 38% subjects, characteristic feature of diabetes was increased blood glucose and decreased insulin level, whereas 26.8% thought that diabetes was featured by decreased blood glucose and increased insulin. According to 44.1% subjects frequent drinking of water was the symptom of diabetes and 39.3% subjects believed that frequent passage of urine was the symptom of diabetes. Most of the subjects were unaware of different types of insulin (65.8%). Most of them were however aware regarding various insulin delivering devices (72.9%). All the subjects preferred lower abdomen as the site of insulin administration. 22.4% of the subjects preferred thigh as the site of insulin administration in addition to lower abdomen.

Regarding adverse effects of insulin, low blood glucose was the most common response (74.9%), whereas 35.3% responses indicated lipodystrophy. According to 38.6% subjects hypoglycaemia was characterised by a blood glucose level of lower than 70 mg/dl. 31.2% subjects opted for less than 60 mg/dl blood glucose level as the definition of hypoglycemia. 45.1% subjects thought rapid heartbeat was the symptom of low blood glucose whereas 38.6% responses indicated sweating as the symptom of low blood glucose. 79.7% subjects did not know about HbA1c. Responses to assess knowledge regarding use and adverse effects of insulin have been presented in Table 1.

Table 1 Response distribution to questions pertaining to knowledge regarding insulin use and adverse effect (n=295)

No	Questions	Response	Response distribution n (%)
1.	Select the correct statement	a) Diabetes is a disease characterized by low blood glucose and low insulin	67(22.7)
		b) Diabetes is a disease characterized by high blood glucose and low insulin	112(38)
		c) Diabetes is a disease characterized by low blood glucose and high insulin	79(26.8)
		d) Diabetes is a disease characterized by high blood glucose and high insulin	37(12.5)
2.	Which of the following is/are the symptoms of diabetes? (Answers may be multiple)	a) Frequent passage of urine	116(39.3)
		b) Frequent eating	69(23.4)
		c) Frequent drinking of water	130(44.1)
		d) Weight loss	91(30.8)
3.	How did you know information about insulin (Answers may be multiple)	a) Books	1(0.3)
		b) Television	0 (0)
		c) Internet	3(1)
		d) Others	295(100)
4.	Are you aware that there are various types of insulin?	a) Yes	101(34.2)
		b) No	194(65.8)
5.	Are you aware that there are various insulin delivering devices?	a) Yes	215(72.9)
		b) No	80(27.1)
6.	Which of the following is/are the preferred sites of injection of insulin? (Answers may be multiple)	a) Upper arm	0 (0)
		b) Thigh	67(22.4)
		c) Lower abdomen	295 (100)
		d) Buttocks	5(1.7)
7.	Which of the following is/are the side effects of insulin therapy? (Answers may be multiple)	a) Low blood glucose	221(74.9)
		b) Lipodystrophy	104(35.3)
		c) Allergy	41(13.9)
		d) Edema	18(6.1)
8.	Hypoglycemia is defined as a blood glucose level of less than	a) 40 mg/dl	26(8.8)
		b) 50 mg/dl	65(22)
		c) 60 mg/dl	92(31.2)
		d) 70 mg/dl	114(38.6)
9.	Which of the following is/are symptoms of low blood glucose? (Answers may be multiple)	a) Sweating	114(38.6)
		b) Rapid heartbeat	133(45.1)
		c) Tremor	111(37.6)
		d) Dizziness	60(20.3)
10.	Do you know about HbA1c, the blood test used for long term control of blood glucose?	a) Yes	60(20.3)
		b) No	235(79.7)

Attitude regarding insulin use and adverse effects

According to most of the subjects insulin could be pre-mixed in the same syringe (66.8%), and could be stopped once blood glucose level normalizes (63.1%). Most of the subjects believed that administration of insulin should not be at the same place (76.3%), extreme level, i.e. too high or too low insulin could drastically alter the blood glucose value (65.8%), insulin could be self-administered (81.4%) and insulin can cause harm (47.1%). Most of them expressed disagreement regarding the fact that diabetes can be controlled by diet alone (47.5%). They also did not consider insulin as the only treatment option for diabetes (68.5%).Most of them did not agree to the fact that following administration of insulin, diet and exercise were not needed to maintain blood glucose level (56.9%). Most of them did not believe that insulin vials having clamps could be administered (58.3%). Table 2 presents the responses to assess attitude regarding use and adverse effects of insulin.

Table 2 Response distribution to questions pertaining to attitude regarding insulin use and adverse effect (n=295)

Questions	Strongly agree n (%)	Agree n (%)	Unsure n (%)	Disagree n (%)	Strongly disagree n (%)
Insulin can be pre-mixed in the same syringe	8(2.7)	197(66.8)	42(14.2)	48(16.3)	0 (0)
Insulin can be stopped once blood glucose level normalize	12(4.1)	186(63.1)	31(10.5)	65(22)	1(0.3)
Insulin should not be administered at the same site	29(9.8)	225(76.3)	16(5.4)	24(8.1)	1(0.3)
Too high or too low insulin can result drastic alterations in blood glucose	15(5.1)	194(65.8)	31(10.5)	55(18.6)	0 (0)
Insulin can be self-administered	40(13.6)	240(81.4)	7(2.4)	8(2.7)	0 (0)
Diabetes can be controlled by diet alone	0 (0)	118(40)	27(9.2)	140(47.5)	10(3.4)
Insulin is the only treatment option for diabetes	2(0.7)	59(20)	24(8.1)	202(68.5)	8(2.7)
Once insulin is started diet and exercise are not needed to maintain	0 (0)	98(33.2)	26(8.8)	168(56.9)	3(1)
Insulin can be administered even if the vial is having clumps	0 (0)	82(27.8)	34(11.5)	172(58.3)	7(2.4)
Insulin can cause harm	2(0.7)	139(47.1)	31(10.5)	122(41.4)	1(0.3)

Practice regarding insulin use and adverse effects

90.5% subjects administered insulin 20 minutes before food. Most of the subjects practiced rotation of sites for insulin injection (89.2%). 83.4% subjects stored insulin at refrigerator above freezing point. 49.2% subjects did not check for expiry date before using insulin. 42.4% subjects would not take the expired insulin, however, equal number of subjects would take it following expiry. Most of the subjects administer insulin subcutaneously holding the needle at 90 degree and retracting the surface injected (76.9%). Most of the subjects did not carry a quickly available blood glucose source when they went out (53.9%). Responses to assess practice regarding use and adverse effects of insulin have been presented in Table 3.

Table 3 Response distribution to questions pertaining to practice regarding insulin use and adverse effect (n=295)

No	Questions	Response	Response distribution n (%)
1.	When do you administer insulin?	a) 20 minutes before food	267(90.5)
		b) With food	13(4.4)
		c) 20 minutes after food	11(3.7)
		d) Anytime	4(1.4)
2.	Do you practice rotation of sites for insulin injection?	a) Yes	263(89.2)
		b) No	30(10.2)
		c) Sometimes	2(0.7)
3.	How do you store insulin?	a) At refrigerator above freezing point	246(83.4)
		b) At room temperature	48(16.3)
		c) At refrigerator in freezing point	0 (0)
		d) Anywhere	1(0.3)
4.	Do you check for expiry date before using insulin?	a) Yes	150(50.8)
		b) No	145(49.2)
5.	What do you do to the expired insulin?	a) Return it to the local pharmacy	9(3.1)
		b) Will not take	125(42.4)
		c) Throw it in the dustbin	36(12.2)
		d) Will take	125(42.4)
6.	How do you administer insulin?	a) Retracting the injected surface, with needle at 45 degree, subcutaneously	45(15.3)
		b) Retracting the injected surface, with needle at 90 degree, subcutaneously	227(76.9)
		c) Retracting the injected surface, with needle at 45 degree, intramuscularly	17(5.8)
		d) Retracting the injected surface, with needle at 90 degree, intramuscularly	4(1.4)

No	Questions	Response	Response distribution n (%)
7.	Do you keep a readily available source of blood glucose when you go out?	a) Yes	124(42)
		b) No	159(53.9)
		c) Sometimes	12(4.1)

Association between different variables with KAP score

Mean score of knowledge and practice of the study population was 8.4 ± 2.35 and 4.95 ± 1.45 respectively. Males were more knowledgeable compared to female (p =0.0063). Family history of diabetes did not have any effect on knowledge (p=0.3609) and practice (p=0.6149) score. Higher education (post-secondary and above) was associated with good practice regarding insulin use (p=0.0287). Longer duration (more than five years) of diabetes was associated with better knowledge regarding insulin use and its adverse effect (p=0.0004). Longer duration (more than four years) of insulin use was found to be associated with better knowledge (p=0.0001) and practice (p=0.0155). Association between different variables with KAP score has been presented in Table 4.

Table 4 Association between different variables with KAP scores
(SD: standard deviation, p- value <0.05 was considered statistically significant)

Variables Score (mean ± SD)		Knowledge		Practice	
		p value	Score (mean ± SD)	p value	
Sex	Male	8.75 ± 2.56	0.0063	5.04 ± 1.44	0.2457
	Female	8.00 ± 2.02		4.85 ± 1.47	
Family history	Positive	8.55 ± 2.16	0.3609	4.90 ± 1.45	0.6149
	Negative	8.29 ± 2.48		4.99 ± 1.46	
Education	Up to secondary school	8.60 ± 2.53	0.0850	5.11 ± 1.39	0.0287
	Below secondary school	8.13 ± 2.06		4.74 ± 1.52	
Duration of diabetes	More than five years	8.90 ± 2.62	0.0004	5.03 ± 1.44	0.3910
	Up to five years	7.83 ± 1.96		4.88 ± 1.47	
Duration of insulin use	More than four years	9.06 ± 2.66	0.0001	5.21 ± 1.26	0.0155
	Up to four years	7.99 ± 2.04		4.79 ± 1.55	

Discussion

Increased urbanization and rural-to-urban migration, sedentary lifestyles, as well as genetic susceptibility have played key roles in the rapid emergence of diabetes as a highly prevalent lifestyle disorder in India; particularly type 2 DM[17]. In addition to appropriate lifestyle modifications and timely initiation of insulin therapy as well as oral anti-diabetic medications, patient education and counselling are an integral part of its management. It is essential to

assess the patient's perspective and knowledge on insulin treatment and to correctly identify the obstacles from the patient's point of view. It was, therefore, our intention to collect and assess data on insulin use through this KAP study.

Present study was conducted over 295 diabetic subjects on insulin therapy. The mean age of the study participants was 51.07 ± 6.45. Predominant type of diabetes in the adult population is type 2. This result showed consistency with the study done by Jaya Prasad Tripathy et al, which found the higher prevalence of diabetes among the population of the age group ranging from 45 to 69 years[17]. Besides, our study showed that males outnumbered the females regarding the incidence of diabetes (53.6%). This was consistent with another study conducted by R.M. Anjana et al, which found the higher prevalence of diabetes among male[18].

With respect to knowledge and attitude, the data obtained from the study population was comparable to other similar KAP studies conducted in India, with certain points of difference. Only 38% of subjects in the study had a satisfactory understanding of the underlying pathophysiology of diabetes, as opposed to 60-77% of subjects in a study conducted on the workers of Bhilai steel plant, comprised mainly of individuals with up to graduation level education[19]. Although a majority (72.9%) had satisfactory knowledge regarding insulin delivery devices, most subjects were not aware of the different types of insulin. Most subjects had an adequate understanding of the potential side effects of insulin therapy, most commonly that of hypoglycemia (74.9%) followed by lipodystrophy (35.3%). Most subjects (79.7%), however, had no knowledge of HbA1c, considered as a blood investigation to assess the long term control of blood glucose.

Some aspects of patients' attitude regarding insulin use and adverse effect were satisfactory. Most of the subjects agreed to the fact that administration of insulin should not be at the same place (76.3%) and that overdosing or under dosing of insulin might drastically alter blood glucose level (65.8%). On the negative aspect, most subjects agreed that following normalization of blood glucose, insulin could be stopped (63.1%), insulin could cause harm (48%). 33.2 % subjects did not consider diet and exercise necessary after starting insulin.

Evaluation of practices concerning insulin administration revealed no considerable lacunae. Most subjects were aware of the correct time for insulin administration, while an overwhelming majority (89.1%) practiced rotation of sites for insulin injection. Most subjects were aware of the correct temperature for storage of insulin,

as well as the correct technique for administration of insulin (76.9%). However, 49.1% of subjects did not check the expiry date before administering insulin, and 42.4 % would take it even if it was expired. Additionally, a majority (53.8%) of subjects did not carry a readily available source of glucose with them while going out. This was especially noteworthy, considering the fact that most patients were aware of hypoglycemia as a common side effect of insulin therapy. In view of the potential life-saving impact of this simple intervention, this lacuna merits further emphasis and assessment, as it provides a scope for improving patient outcomes through better interpersonal communication in diabetic clinics.

Higher education (post-secondary and above) was associated with good practice regarding insulin use (p=0.0287). Longer duration (more than five years) of diabetes was associated with better knowledge regarding insulin use and its adverse effect (p=0.0004). Longer duration (more than four years) of insulin use was found to be associated with better knowledge (p=0.0001) and practice (p=0.0155). This showed consistency with a study done by Sourav Das Choudhury et al, which found that longer duration of DM (>10 years) was associated with awareness of continuing insulin use (p = 0.031). They also found the association between prolonged duration of insulin use (>3 years) and better understanding (p< 0.05) of the usefulness of insulin and the confidence for self-administration of the injection[20].

Despite taking care to spread out the collection of data over the allotted duration of research, the study had its own limitations. Data collection was done at a single center catering largely to an urban and semi-urban population. The restrictions imposed because of coronavirus disease 2019 (COVID-19) may also have acted as a confounding factor, inadvertently leading to lower representation of rural and semi-rural population in the study sample. As it was a cross-sectional study, no further follow-up of subjects on subsequent OPD visits was possible.

Conclusion

We conclude that a proper educational intervention is needed that may create the awareness among the insulin users on the aspect of knowledge that would rather improve their attitude and practice regarding insulin use and adverse effects. In this regard there may be provision for a clinical pharmacist who may play an important role as patient education. Activities like counselling of the patients, review of home medication and programme on pharmaceutical care may help to improve the

patients' practice regarding disease management.

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